In the Claims

Please add claims 128-155 as follows:

128. A system for performing PCR and monitoring the reaction in real time during temperature cycling comprising;

a sample container for holding a PCR sample, the sample container comprising an optically clear material, the sample container holding less than 1 milliliter of a sample and having a first side, a second side, and an end;

means for positioning the PCR sample in a monitoring position;

means for heating the PCR sample;

means for cooling the PCR sample;

control means for repeatedly operating the means for heating and the means for cooling to subject the PCR sample to thermal cycling;

means for optically exciting the sample to cause the sample to fluoresce;

means for detecting the fluorescence of the excited sample;

means for determining at least one reaction parameter in accordance with the detected fluorescence; and

means for adjusting the control means in accordance with the reaction parameter.

129. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 128 in which the control means adjusts the

operation of the means for heating and the means for cooling to alter the times the means for heating and the means for cooling operate in accordance with the reaction parameter.

130. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 128 in which the control means adjusts the operation of the means for heating and the means for cooling to alter the rate at which the biological sample is heated and cooled in accordance with the reaction parameter.

131. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 128 wherein the means for positioning the PCR sample in a monitoring position comprises a rotatable carousel.

132. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 128 further comprising means for positioning the means for optically exciting the sample and the means for detecting the fluorescence of excited sample to optimize the fluorescence which is detected.

C1 Cont.

133. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 128 wherein the means for heating the PCR sample comprises a forced air heater.

134. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 128 wherein the means for cooling comprises an air movement mechanism which transports ambient air to the sample container.

135. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 128 wherein the control means comprises a microprocessor.

136. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 128 wherein the means for optically exciting the sample comprises a photo emitter structure positioned so that the radiation emitted therefrom impinges the side of the sample container.

137. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 136 wherein means for detecting the fluorescence of the excited sample comprises a photo detector structure positioned so that the radiation emitted from the side of the sample container is detected.

138. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 128 wherein the means for optically exciting the sample comprises a photo emitter structure positioned so that the radiation emitted therefrom impinges the end of the sample container.

139. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 138 wherein the means for detecting the fluorescence of the excited sample comprises a photo detector structure positioned so that the radiation emitted from the end of the sample container is detected.

140. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 128 wherein the means for determining at least one reaction parameter in accordance with the detected fluorescence comprises means for determining at least one reaction parameter selected from the group consisting of: product melting temperature, product melting time, product reannealing temperature, product reannealing time, probe melting time, primer annealing/extension temperature, and primer annealing/extension time.

141. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 128 wherein the control means comprises means cooling the sample when the means for detecting the fluorescence of the excited sample detects that the product is completely melted.

142. A system for performing PCR and monitoring reaction in real time during temperature cycling as defined in claim 128 wherein the control means comprises means for heating the sample when the means for detecting the fluorescence of the excited sample detects no more product generation.

143. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 128 wherein the means for optically exciting is positioned to interact with the first side of the sample container and the means for detecting the fluorescence is positioned to interact with the second side of the sample container.

144. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 128 wherein the means for optically exciting is positioned to interact with the end of the sample container and the means for detecting the fluorescence is also positioned to interact with the end of the sample container.

145. A system for performing PCR and monitoring the reaction in real time during temperature cycling comprising:

a plurality of sample containers for holding a plurality of PCR samples, each sample container comprising an optically clear capillary tube, each sample container holding less than 1 milliliter of a sample and having a sealed end and an open end with a sealable closure on the open end;

means for holding a plurality of sample containers, the means for holding comprising a rotatable carousel holding the sample containers;

means for forcing hot fluid into contact with the plurality of sample containers;

means for forcing cool fluid into contact with the plurality of sample containers;

means for repeatedly operating the means for forcing hot fluid and the means for forcing cool fluid to subject the PCR samples to thermal cycling;

means for optically exciting at least one selected PCR sample to cause the selected PCR sample to fluoresce;

means for detecting the fluorescence of the excited selected PCR sample at both a first wavelength and a second wavelength;

means for determining at least one reaction parameter for the selected PCR sample in accordance with the detected fluorescence at the first and second wavelengths and displaying the reaction parameter in a visually perceptible manner in real time; and

means for adjusting the means for repeatedly operating in accordance with the reaction parameter such that the reaction is adjusted in real time.

C1

146. A system for performing PCR and monitoring the reaction in real time during temperature cycling as defined in claim 145 wherein the means for determining at least one reaction parameter in accordance with the detected fluorescence at the first and second wavelengths and displaying the reaction parameter in a visually perceptible manner in real time comprises means for determining a reaction parameter selected from the group consisting of denaturation temperature and time, primer annealing temperature and time, probe annealing temperature and time, enzyme extension temperature and time, and number of cycles.

147. A system for performing PCR and monitoring the reaction in real time comprising;

a chamber;

a heater and a fan mounted in air flow communication with the chamber and a controller for cycling the temperature in the chamber according to initial predefined temperature and time parameters;

a carousel for holding a plurality of sample vessels, said carousel being rotatably mounted in said chamber, said sample vessels comprising an optically transparent material and walls defining a volume having at least first and second dimensions wherein the first dimension is less than the second dimension and wherein the ratio of volume to external surface area of the vessel is less than 1mm;

a light emitting source mounted in said chamber and positioned to illuminate at least one of the sample vessels along an axis substantially parallel to a wall along the second dimension of the vessel;

a light detector mounted in said chamber and positioned to measure fluorescence from at least one of the sample vessels along an axis substantially parallel to a wall along the second dimension of the vessel;

C1 Cont.

means for displaying the status of the reaction based detected fluorescence; and

means for adjusting the controller such that one or more reaction parameters the reaction is adjusted in real time.

148. The system of claim 147 wherein the carousel comprises:

a disc having a top surface, a bottom surface, an outer edge extending therebetween, a sample receiving port in the top surface, a sample vessel port in the outer

edge, and a sample passageway communicating with said sample receiving port and the sample vessel port, said sample vessel port and passageway formed for receiving and fixing a sample vessel to the disc.

149. The system of claim 148 wherein the passageway of the carousel includes a barrier that prevents a liquid sample delivered through the sample receiving port from flowing to the sample vessel port absent a biasing force on said liquid sample.

150. The system of claim 149 further comprising a motor for rotating the carousel to provide the biasing force on the liquid sample to deliver the liquid sample through the sample receiving port.

151. The system of claim 147 wherein the sample vessels are capillary tubes having an inner diameter ranging from about 0.02mm to about 1.0mm.

152. A system for performing PCR and monitoring the reaction in real time comprising:

SUB D14

C1 Cont.

a chamber;

a heater and a fan in air flow communication with the chamber and a controller for cycling the temperature in the chamber according to initial predefined temperature and time parameters;

a carousel for holding a plurality of sample vessels said carousel being rotatably mounted in said chamber; the carousel comprising a disc having a top surface, a bottom surface, and an outer edge extending therebetween, a sample receiving port in the top surface, a sample vessel port in the outer edge, and a sample passageway communicating with said sample receiving port and the sample vessel port, said sample vessel port and passageway formed for receiving and fixing a sample vessel to the disc; the passageway including a barrier that prevents a liquid

sample delivered through the sample receiving port from flowing to the sample vessel port absent a biasing force on said liquid sample;

said sample vessels comprising an optically transparent material and walls defining a volume having at least first and second dimensions wherein the first dimension is less than the second dimension and wherein the ratio of volume to external surface area of the vessel is less than 1mm;

a light emitting source positioned to illuminate at least one of the sample vessels along an axis substantially parallel to a wall along the second dimension of the vessel;

a light detector positioned to measure fluorescence from at least one of the sample vessels along an axis substantially parallel to a wall along the second dimension of the vessel; and

a display for displaying the status of the reaction based detected fluorescence.

C' Cont

153. The system of claim 152 further comprising a motor for rotating the carousel to provide a biasing force on a liquid sample delivered through the sample receiving port.

154. The system of claim 152 further comprising an adjuster for adjusting the controller such that one or more reaction parameters the reaction is adjusted in real time.

155. The system of claim 152 wherein the sample vessels are capillary tubes each having an inner diameter ranging from about 0.02 mm to about 1.0 mm.

REMARKS

Claims 128-155 have been added. The examiner has indicated that claims 14-17, 34, 88, 91, 92, and 126-127 contain allowable subject matter. New claim 128 contains the subject matter of claim 14 and is written in independent form including all limitations of